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(54) Abstract Title

Device for operating a selector shaft of a shift transmission

(57) The selector shaft can be swivelled about an axis and is displaceable along the axis. The device also contains a swivel actuator 26 for swivelling the selector shaft and a displacement actuator 24 for displacing the selector shaft. At least one of the two actuators 24,26 operates the selector shaft 2 by means of a component 12,14 which can be swivelled by the actuator about an axis AA which is locally fixed relative to a housing of the shift transmission. The component is in positive locking engagement with the selector shaft relative to the swivel or displacement movement of the selector shaft produced by the actuator, but is out of engagement relative to the displacement or swivel movement of the selector shaft.

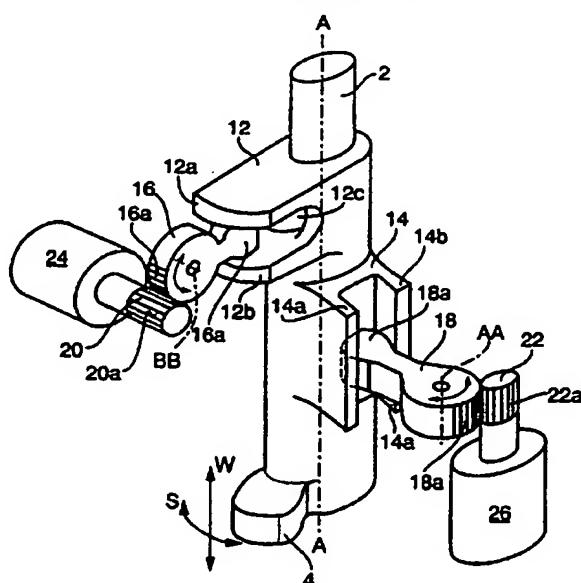


Fig. 1

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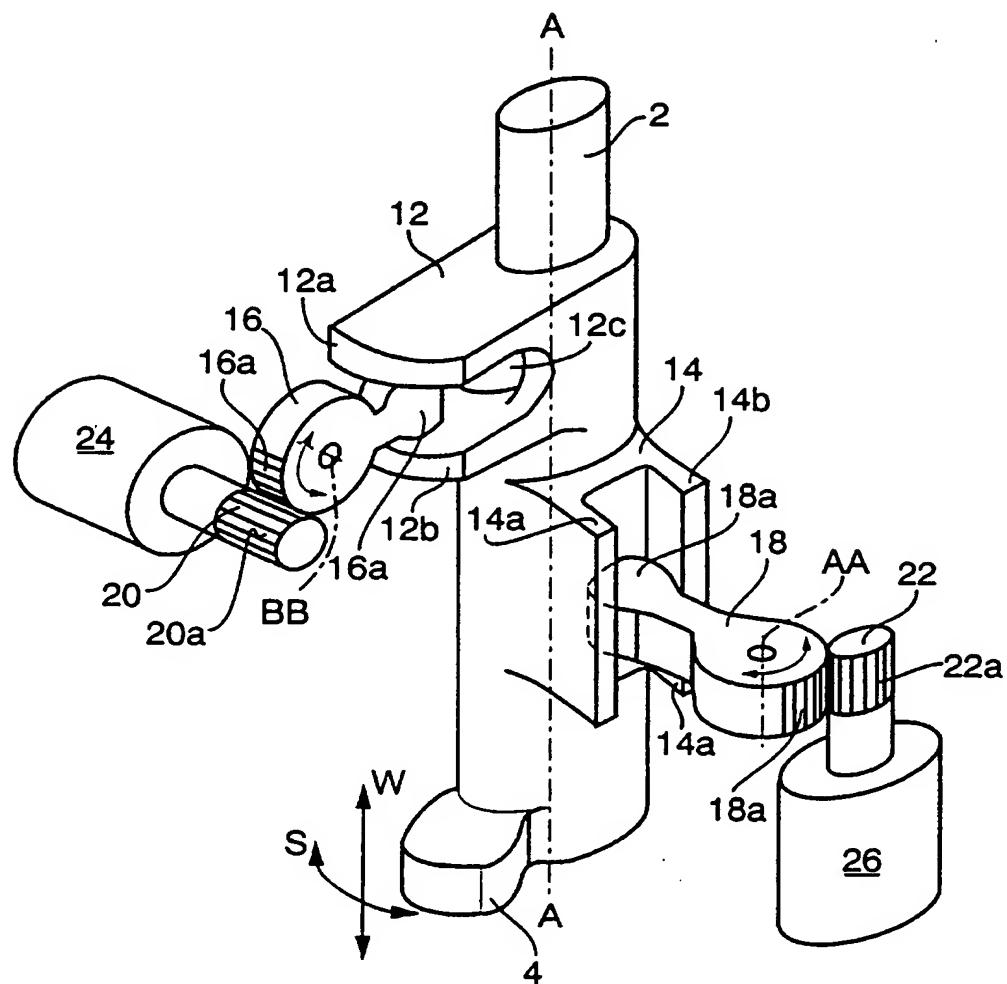


Fig. 1

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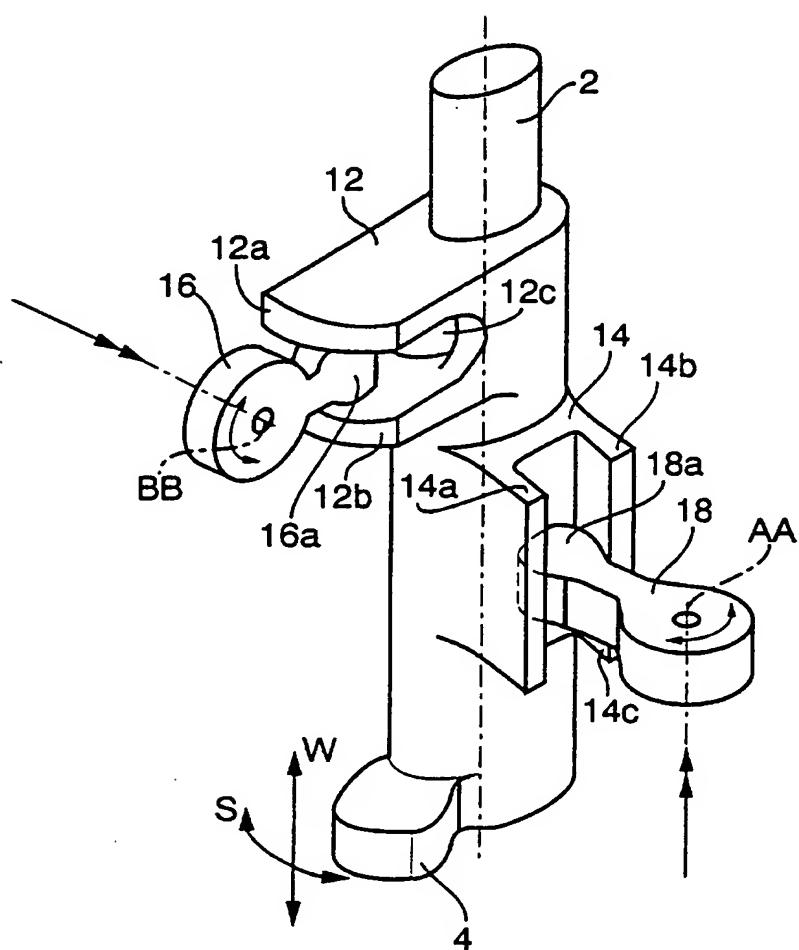


Fig. 2

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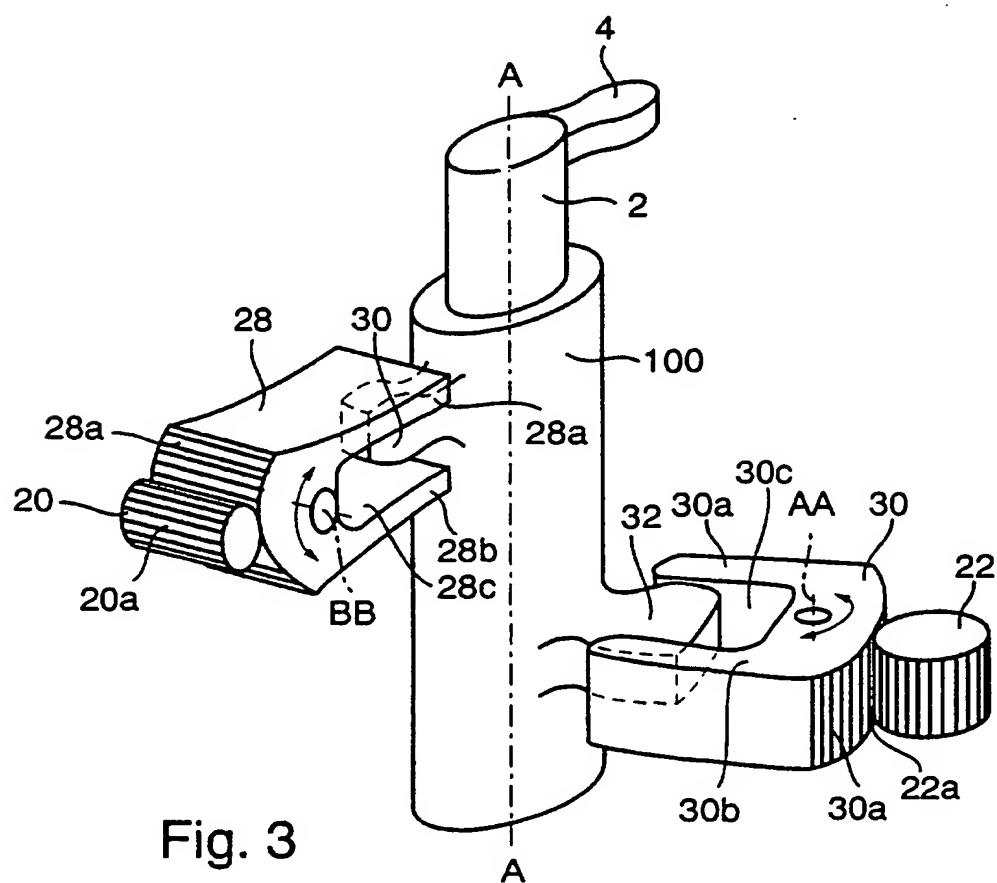


Fig. 3

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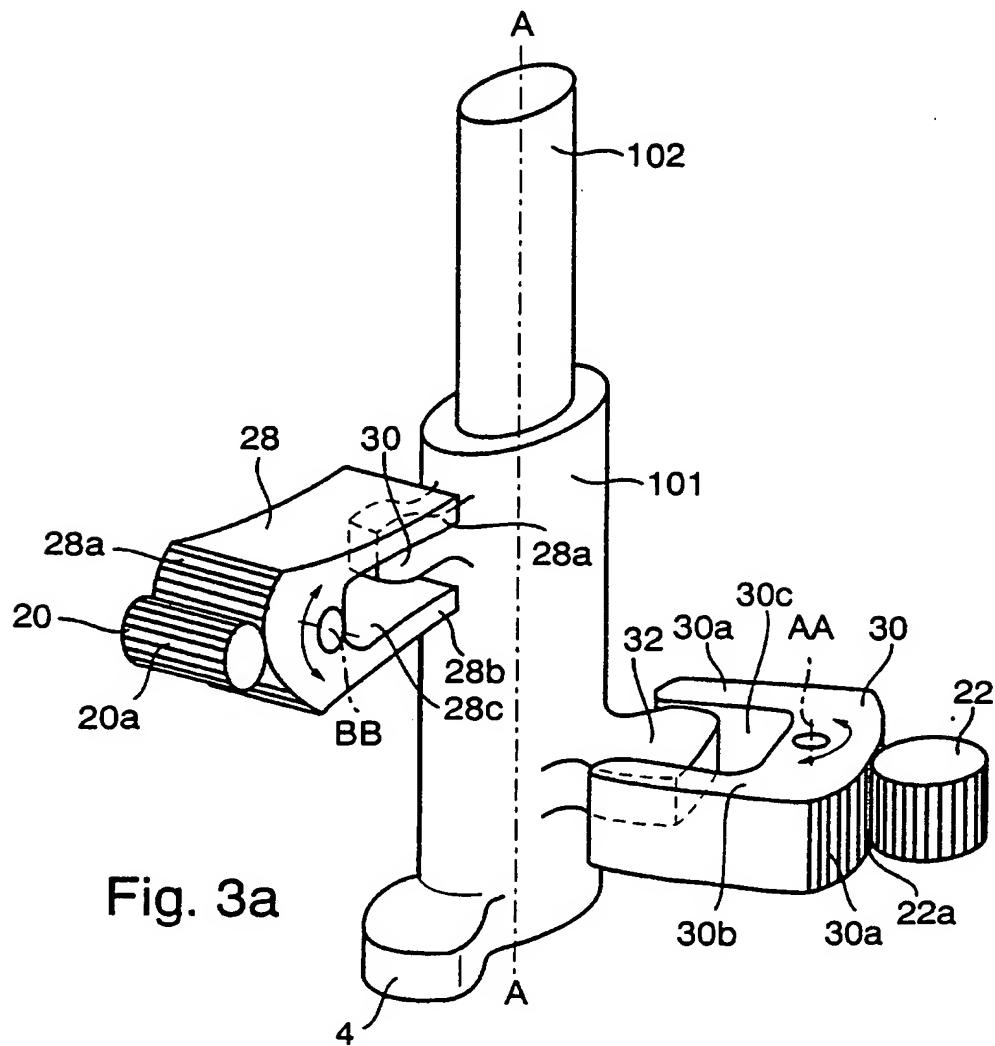


Fig. 3a

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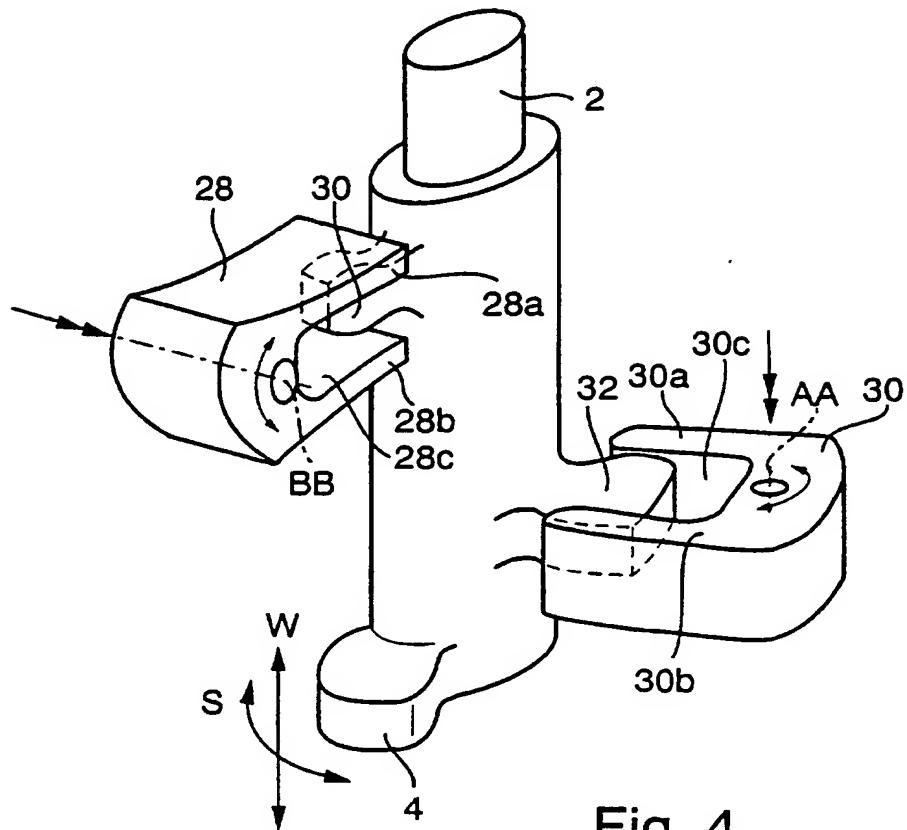


Fig. 4

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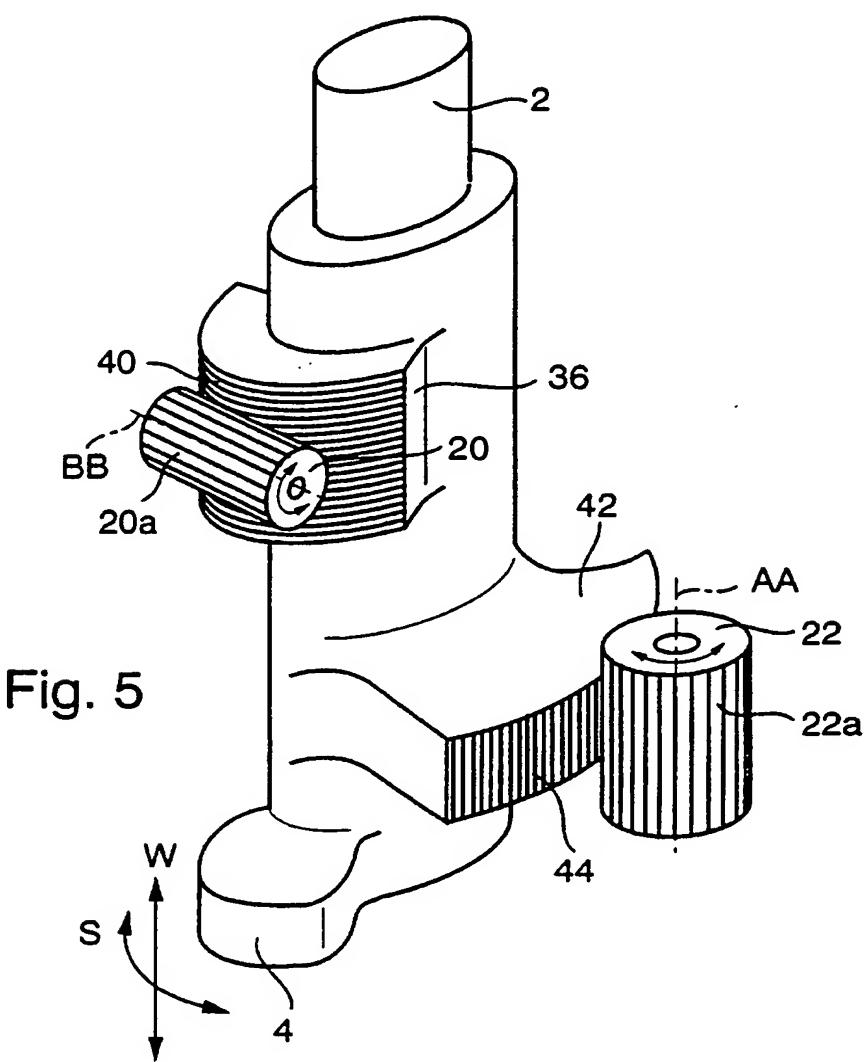


Fig. 5

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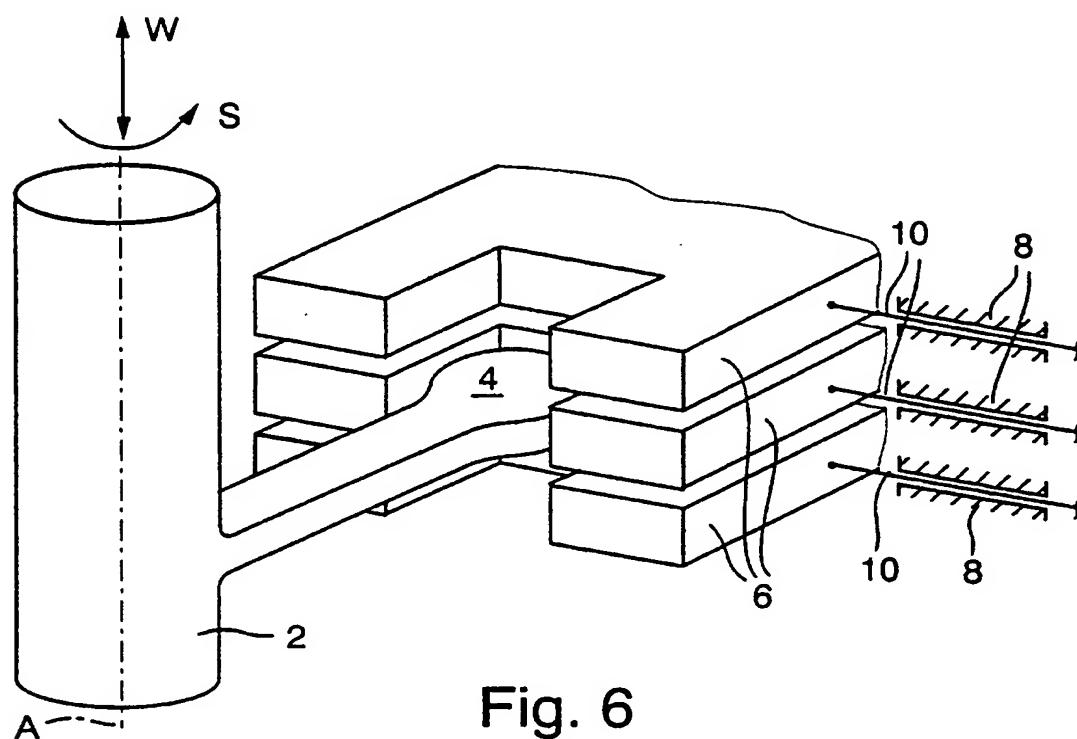


Fig. 6

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Device for operating a selector shaft of  
a shift transmission

- The invention relates to a device for operating a selector shaft of a shift transmission which can be swivelled about an axis and is displaceable along the axis, containing a swivel actor for swivelling the selector shaft and a displacement actor for displacing the selector shaft.
- Automating shift transmissions has grown in importance in recent times. On the one hand such automated shift transmissions are more cost-effective than conventional automatic gearboxes which normally operate with planetary sets or are formed as belt contact gearboxes with continuously variable transmission. On the other hand automated shift transmissions work with a better degree of efficiency than conventional automatic gearboxes so that the improvement in comfort need not be paid for by increased fuel consumption.
- A selector shaft as shown in Figure 6 is normally used for operating conventional shift transmissions. The selector shaft 2 is displaceable on a gearbox housing (not shown) along the axis A and is guided for swivel movement about the axis and has a shift finger 4 which engages in mouths of selector forks 6. Each of the selector forks 6 is attached to a shift rod 10 guided in the gearbox housing by means of linear guides 8 whereby a further fork (not shown) is fixed to each other end to operate a synchroniser sleeve for synchronising the relevant gear. During linear displacement in the direction of the double arrow W the selector shaft 2 executes a rolling movement whereby it is determined in which of the selector forks 6 the shift finger 4 engages, i.e. which of the selector forks is then moved during swivel movement of the selector shaft 2 in the direction of the double arrow S and thus

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which gears are shifted. Selection is likewise possible through rotary movement of the shaft and shifting is possible through linear movement of the shaft.

- 5 When automating a shift transmission-operating device of this kind one actor is provided each for swivelling and for displacing the selector shaft and the actors are connected to the selector shaft through an associated structural connecting assembly. With an operating device  
10 known from US 4 856 360 the two actors have linearly displaceable operating members. The operating member for displacing the selector shaft is connected to the selector shaft by a component part which is rigidly connected to the selector shaft regarding its axial direction but which  
15 allows relative rotation of the selector shaft. The operating member for swivelling the selector shaft engages in a swivel lever connected rigidly to the selector shaft so that during its activation it produces a swivel movement of the selector shaft but with an axial  
20 displacement of the selector shaft a corresponding relative movement is possible between the operating member and shift lever.

The object of the present invention is to provide a device  
25 of the kind already mentioned which with a simple construction allows precision operation of the selector shaft wherein the swivel and displacement movements of the selector shaft take place independently of each other.

- 30 This is achieved with the features of the main claim.

Further advantageous developments of the device according to the invention are characterised in the sub-claims.

- 35 The invention will now be explained in detail by way of example with reference to the following drawings in which:

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Figures 1 to 5 show perspective views of different embodiments of the device according to the invention; and

5

Figure 6 is a perspective view for illustrating the interaction of the selector shaft with selector forks in the case of a conventional manual transmission.

10

According to Figure 1 a central guide axis or selector shaft 2 which has a shift finger 4 is formed in a thickened area integral with forks 12 and 14. The arms 12a and 12b of the forks form between them a circumferential groove 12c which is concentric with the axis of the selector shaft 2. The groove need not necessarily be formed concentric. It can also be formed straight and stand perpendicular on the axis of the selector shaft. Similarly the arms 14a and 14b of the fork 14 form a groove 14c running parallel to the axis of the selector shaft 2.

The central guide axis can either be formed fixed on the housing whereby the selector shaft is then formed longitudinally movable relative to this guide axis or is mounted on the guide axis, or the guide axis is mounted longitudinally movable and rotatable in the gearbox housing or in a built-on housing wherein the selector shaft is connected fixed to the guide axis or is formed in one piece therewith.

Next to each fork 12 and 14 a component part 16, 18 is mounted to swivel about an axis fixed on the gearbox housing and engages with a projection 16a, 18a into the groove 12c, 14c.

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On the side remote from the projection each component part 16, 18 has teething 16a, 18a which mesh with further teething 20a, 20b which are formed on the drive shaft 20, 22 of an electric motor 24, 26.

5

Each of the grooves 12c, 14c is matched with the associated projection 16a, 18a so that the projection directly adjoins the inner walls of the arms but is movable in the longitudinal direction of the groove. The 10 projections are ball-shaped so that swivelling is possible and a freedom of play is substantially obtained.

The function of the device described is as follows:

15 If for example the electric motor 24 serving as the actor is controlled by a control device (not shown), the component part 16 is swivelled whereby through keyed engagement in the vertical direction between the projection 16a and the fork 12 the selector shaft 2 is moved up or down accordingly direct. The projection 18b can thereby be moved in the longitudinal direction of the groove 14c relative to same so that the displacement movement of the selector shaft 2 in the direction of selecting a shift gate is not blocked by the component 25 part 18.

If on the other side the electric motor 26 forming a further actor is operated then the component part 18 is swivelled so that through the keyed engagement between the 30 projection 18a and the fork 14 the selector shaft 2 is swivelled without this swivel movement being hindered by the component part 16. The selector shaft 2 executes a shift movement or causes a shift process.

35 With a simple construction of the device a reliable operation of the selector shaft 2 is achieved whereby the

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selection process is carried completely independently of the shift process.

It is obvious that numerous modifications of the device described are possible; for example a reduction gear can be provided between each of the electric motors 24 and 26 and the associated drive shaft 20, 22 to allow the use of smaller electric motors. It is further obvious that depending on the design of the gearbox the displacement movement of the selector shaft 2 can be connected with a shift process and the swivel movement can be connected with a selection process.

The embodiment according to Figure 2 differs from that in Figure 1 mainly in that as indicated by the double arrows in the same direction the component parts 16 and 18 are fixed direct rigidly to a shaft mounted fixed relative to the gearbox housing and driven in rotation by an associated actor, so that the teeth of Figure 1 are omitted. Otherwise the method of operation of the device of Figure 2 corresponds to that of Figure 1.

The embodiment according to Figure 3 differs from that in Figure 1 mainly in that the component parts 28, 30 mounted fixed on the gearbox housing are formed overall U-shaped or fork-shaped whereby the bearing axis is located each time in the base of the component parts and the arms 26a and 28b or 30a and 30b which form between same the grooves 28a and 30c respectively each receive a projection 30, 32 which is formed integral with the selector shaft 2. In this embodiment the shaft 2 is mounted movable relative to the housing. The movement takes place along the axis A-A. The shaft 100 is connected integral or rotationally secured with the shaft 2 whereby the shaft 2 has the shift finger 4. The shaft 100 can likewise have the shift finger 4. The shaft 2 engages by the journal 4 in the

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gearbox and operates shift elements inside the gearbox. The shaft 100 can be mounted outside of the gearbox whereby the shaft 100 can be mounted inside its own housing.

5

With the embodiment of Figure 3a the shaft 102 is mounted fixed relative to the housing and the hollow shaft 101 is movable and rotatable relative to the shaft 102. The hollow shaft 101 is mounted and guided on the shaft 102.

10 The shaft 102 and the shaft 101 are mounted so that the journal 4 engages in the gearbox and switches shift elements inside the gearbox.

The outsides of the bases of the component parts 28, 30  
15 are each provided with teeth 28a, 30a which mesh with corresponding teeth 20a, 22a of the drive shafts 20, 22. Each of the projections 30, 32 is, similar to the embodiment according to Figure 1, matched with the groove 28c, 30c so that a direct keyed engagement is provided in  
20 the operating direction but relative movement is provided perpendicular thereto. It is obvious that the bearing axis of the component part 30 is parallel to the axis of the selector shaft 2 whilst the bearing axis of the component part 28 is perpendicular to the axis of the  
25 selector shaft 2. The function of the arrangement according to Figure 3 corresponds moreover to that of Figure 1.

The embodiment according to Figure 4 differs from that of  
30 Figure 3 in the same way as the embodiment according to Figure 2 differs from that in Figure 1. The component parts 28, 30 are not provided with teeth but are connected rigidly direct to each one of the shafts driven by one of the actors and are thereby mounted at the same time fixed  
35 relative to the gearbox housing. The function of the

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device according to Figure 4 corresponds moreover to that of Figure 3.

- With the arrangement according to Figure 5 the selector  
5 shaft 2 has an attachment 36 which has teething 40 whose  
teeth extend circumferentially concentric with the axis of  
the selector shaft 2. The teething 40 meshes with  
teething of a rotary-driven drive shaft 20 which is  
mounted fixed on the gearbox housing and which has  
10 teething 44 which is overall coaxial with the axis of the  
selector shaft 2, with the teeth however running axially  
parallel. The teething 44 meshes with corresponding  
teething of a rotary-driven drive shaft 22.
- 15 The function of the device according to Figure 5 is as follows:

- Rotation of the drive shaft 22 leads to a corresponding  
swivel movement of the selector shaft 2 wherein this  
20 swivel movement is not hindered through the engagement  
between the teeth 40 and teeth of the drive shaft 20 since  
both sets of teeth can be displaced relative to each other  
in the direction of their individual cogs.
- 25 If the drive shaft 20 is turned then the selector shaft 2  
is displaced axially whereby this displacement is not  
hindered by the engagement between the teeth 44 and the  
teeth of the drive shaft 22 since both can be displaced  
30 relative to each other without the toothed engagement  
being lost. The embodiment of the device according to  
Figure 5 is particularly simple since it requires a  
minimum of component parts.

- 35 The embodiments described can be modified in many respects  
and can be combined together. By way of example the teeth  
in the embodiments according to Figure 1 or Figure 3 can

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also be designed as non-circular teething which compensate different lever transmission ratios according to the angular position of the component parts 16 and 18 or 28 and 30.

5

The patent claims filed with the application are proposed wordings without prejudice for obtaining wider patent protection. The applicant retains the right to claim further features disclosed up until now only in the 10 description and/or drawings.

References used in the sub-claims refer to further designs of the subject of the main claim through the features of each relevant sub-claim; they are not to be regarded as 15 dispensing with obtaining an independent subject protection for the features of the sub-claims referred to.

The subjects of these sub-claims however also form independent inventions which have a design independent of 20 the subjects of the preceding claims.

The invention is also not restricted to the embodiments of the description. Rather numerous amendments and modifications are possible within the scope of the 25 invention, particularly those variations, elements and combinations and/or materials which are inventive for example through combination or modification of individual features or elements or process steps contained in the drawings and described in connection with the general 30 description and embodiments and claims and which through combinable features lead to a new subject or to new process steps or sequence of process steps insofar as these refer to manufacturing, test and work processes.

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1. Device for operating a shaft, such as a selector shaft, of a shift transmission, which can swivel about an axis and is displaceable along the axis, containing a swivel actor for swivelling the selector shaft and a displacement actor for displacing the selector shaft, characterised in that at least one of the two actors operates the selector shaft by means of a component part which is mounted rotatable inside the housing relative to a fixed guide axis and is drivable by the actor, wherein the component part can be swivelled by the actor about an axis which is locally fixed relative to a housing of the shift transmission and is in positive locking engagement with the selector shaft regarding the swivel or displacement movement produced by the actor, but is out of engagement with regard to the displacement or swivel movement.
2. Device according to claim 1 characterised in that the component part has teething which mesh with teething of a drive component which is driven in rotation by the actor.
3. Device according to claim 1 characterised in that the component part is mounted directly on a shaft driven by the actor.
- 25 4. Device according to one of claims 1 to 3 characterised in that the component part ends in a projection which engages in a fork formed on the selector shaft wherein the keyed engagement is provided by the projection bearing against the inner faces of the fork arms, and the projection is movable along a groove formed between the fork arms.
- 30 35 5. Device according to one of claims 1 to 3 characterised in that the component part ends in a fork in which a projection formed on the selector shaft engages

- 10 -

wherein the keyed engagement is produced by the projection bearing against the inner faces of the fork arms and the projection is movable along a groove formed between the fork arms.

5

6. Device according to one of claims 1 to 3 characterised in that the component part is formed as a pinion of a drive shaft with teeth whose teeth run parallel to the axis of rotation and mesh with teeth formed on the selector shaft to produce a keyed engagement in the circumferential direction of the drive shaft and to allow relative displacement of the teeth parallel to the axis.

15

7. Device according to one of claims 1 to 6 characterised in that both actors activate the selector shaft each by means of a component part which can be swivelled by the associated actor about an axis locally fixed relative to a housing of the shift transmission and which is in keyed engagement with the selector shaft regarding the swivel or displacement movement produced by the actor but is out of engagement regarding displacement or swivel movement.

25

8. Device according to claim 1 characterised in that the support bearing for the rotatable component part is provided each time about a guide axis which is parallel to the axis of rotation of the selector shaft.

30

9. Device according to claim 8 characterised in that the guide axis forms a radial guide relative to the rotary movement of the selector shaft.

35

10. Device according to claim 8 characterised in that the guide axis forms an axial guide relative to the axial movement of the selector shaft.

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11. Device for operating a shaft substantially as herein described with reference to the accompanying drawings.



The  
Patent  
Office  
*ja*

Application No: GB 9811232.9  
Claims searched: 1 to 11

Examiner: Jim Calvert  
Date of search: 21 September 1998

## Patents Act 1977

### Search Report under Section 17

#### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F2D(DBD)

Int Cl (Ed.6): F16H 63/20, 63/30

Other: Online: EDOC

#### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB2271400A (MASSEY-FERGUSON) See.fig. 2- arm 19 and actuators 15-19 and 28,29	1,3
X	EP0488857A1 (PEUGOT/CITROEN) See fork arm 22 in fig. 1	1,3

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|---|---|---|--|
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| Y | Document indicating lack of inventive step if combined with one or more other documents of same category. | P | Document published on or after the declared priority date but before the filing date of this invention.          |
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